AIRS Applications

Status of Applications

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Defining "Applications"

it's NOT research

"…our data could be used in a model that shows…"

it's NOT PR

"NASA Earth scientists gave a hyperwall presentation to members of the World Bank Agricultural delegation to inform them that NASA has several data products that can be used to determine agricultural yields…"

Applications

Science products that are
used by decision makers
or are in a
decision making pipeline

Converting science information into products for use by decision makers

NASA Applied Sciences Program

"Welcome to the NASA Applied Sciences Program. The Program *funds projects that enable innovative uses of NASA Earth science data in organizations' policy, business, and management decisions.* The project results and enhanced decision making improve the quality of life and strengthen the economy."

"Discovering innovative and practical uses of Earth observations"

Decision-making pipeline

Path that starts with data and ends with decision-maker

Task: **Identify the steps in between**

Why know the pipeline?

We can identify where our product would have relevancy and who might be interested in it. *Discuss product concept with potential users, get feedback, guidance*

We can ask people in the know about the M.O. of decision makers—d.m. needs may be less refined than what we assume

Can determine if we're going to step on toes
see the conduits to the appropriate organizations

Benefits

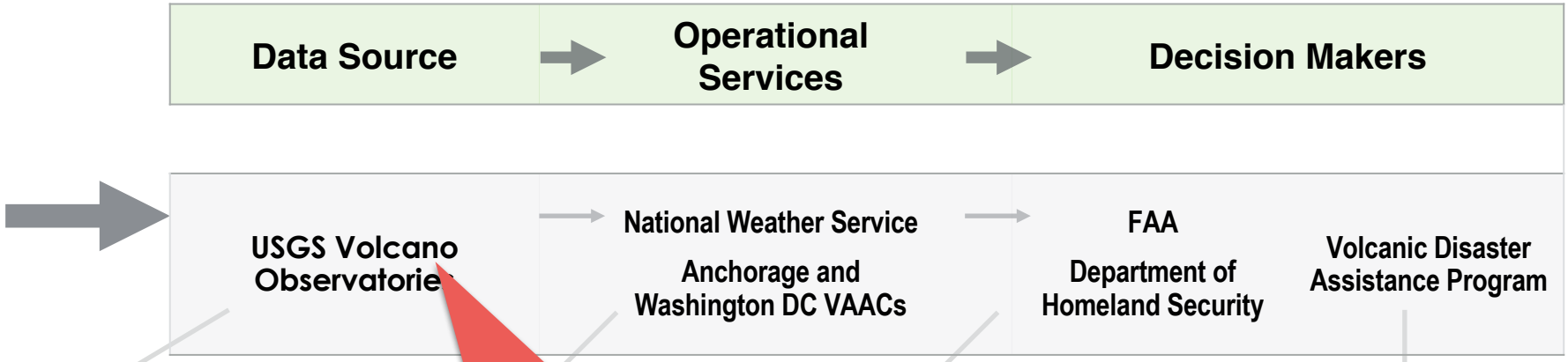
Save time and money

Make a better product

Cultivate partners, advocates

Improve chance of successful outcome

U.S. Volcanic Emissions Decision Pipeline



VOs

- 5 observatories monitor/report on eruptive behavior
- Develop research models of ash dispersion and ashfall
- Sends reports to the NWS

NOAA NWS

- Run operational ash dispersion models
- Formal guidance about what to do comes from the NWS
- NWS gets *its* guidance and information from the USGS

NOAA Volcanic Ash Advisory Centers

- Only deal with ash—they report the extent and movement of ash
- The National Weather Service is really the VAAC

FAA

Looks at NWS products and makes aviation-related decisions

Department of Homeland Security

Decides on whether there should be an evacuation

VDAP

- USGS + Office of Foreign Disaster Assistance partnership, developed/funds VDAP
- Developing countries contact US State Dept which contacts VDAP
- Responds to select volcanic crises worldwide, works to reduce fatalities, economic loss
- Works through USAID, USGS scientists rapidly respond with consultation, forecasting, remote sensing data, monitoring equipment
- Between crises VDAP works with international partners to build/improve volcano monitoring systems; conducts joint activities to reduce volcanic risk and improve understanding of volcanic hazards
- Jewel in the crown of the USGS

To contribute to aviation, AIRS volcanic emission products would fit in the pipeline here

When it comes to applications,
“The perfect is the enemy of the good”

AIRS Applications Catalog – *Fluid!*

Product	Technical Lead	Objective
DROUGHT		
Vapor Pressure Deficit & Relative Humidty	Stephanie Granger, Ali Behrangi (JPL)	Analysis and development of AIRS products to advance understanding of atmospheric conditions leading to drought and its environmental impacts, and to support national efforts such as the National Drought Mitigation Center.
Standardized RH Index	Amir AghaKouchak, Alireza Farahmand (UC Irvine)	Provide snapshots of climate variables to support early detection of ecological health conditions.
FIRE		
Fire Danger Assessment System	JT Reager, Ali Behrangi, Natasha Stavros (JPL) James Randerson (UCI)	Build formal relationship between JPL and operational fire science community by assembling global fire-potential mapped data product and make it publicly accessible.
Indonesia Fires Seasonal Threshold	Robert Field (NASA GISS/Columbia University)	Compare satellite data to historical record of previous fire episodes. Determine seasonal rainfall threshold to create benchmark for predicting and preparing for potential fire episodes in the region.
HEALTH		
Influenza	Joao Teixeira (JPL), Heidar Thrastarson (UCLA-JIFRESSE/JPL)	Monitoring and prediction system
Zika	Joao Teixeira (JPL), Heidar Thrastarson (UCLA-JIFRESSE/JPL)	Monitoring tool
Dengue Fever	Darren Drewry (JPL)	Outbreak prediction indicator
Temperature Inversion	Eric Fetzer (JPL)	TI's have been linked to health effects due to increased pollution levels– develop temperature inversion strength product for health workers and other potential users.
AIR QUALITY		
Air pollution CO tracer	Meiyun Lin (Princeton) Juying Warner (UMBC)	Create product that can be used by western US air quality management.
Ozone intrusion from stratosphere into troposphere	Meiyun Lin, Princeton	Create NRT ozone intrusion product, can be used to determine if surface ozone exceedances are due to an exceptional event associated with a stratospheric intrusion.

Product	Technical Lead	Objective
AVIATION		
JPL internal volcanic alert system	Vince Realmuto (JPL)	Alert system, when activated, automatically produces suite of volcanic-emission products
SO2 BT Diff	Vince Realmuto (JPL)	*(Associated with volcanic emissions)* Make plots publicly available, inform volcanic observatory contacts
Dust Score	Vince Realmuto (JPL)	*(Associated with volcanic emissions)* Make plots publicly available, inform volcanic observatory contacts
SO2 Loading	Sergio DeSouza-Machado (UMBC)	*(Associated with volcanic emissions)* Make plots publicly available, inform volcanic observatory contacts
Ash/dust Loading	Sergio DeSouza-Machado (UMBC)	*(Associated with volcanic emissions)* Make plots publicly available, inform volcanic observatory contacts
Cold Air Aloft	Chris Barnet (STC)	Determine if AIRS can provide value-added products for aviation, develop candidate products working under guidance from C. Barnet & Brad Zavodsky (SPoRT).
Deep Convective Clouds	George Aumann (JPL)	Post maps, explore utility of maps to aviation.
OTHER		
Global Extremes from AIRS L2 Data	Joao Teixeira (JPL)	Extremes map could be used as alert system for multiple natural hazards.
Heat/Comfort/Misery Index	Ali Behrangi (JPL)	Post maps, assess utility for general public
Global Ammonia	Juying Warner (UMBC)	Create product that flags high concentrations of NH3 globally. Determine application communities.

AIRS & Drought | Vapor Pressure Deficit & RH

Stephanie Granger, Ali Behrangi, JPL

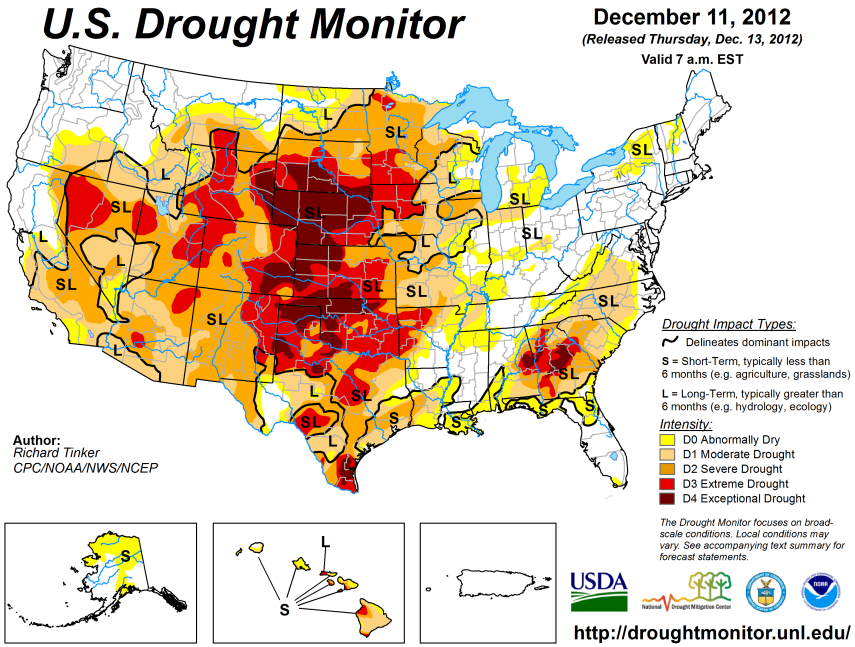
OBJECTIVE

Analysis and development of customized products based on AIRS near surface temperature and humidity to:

1) **Support the National Drought Mitigation Center's (NDMC) assessment of AIRS products for potential inclusion in the United States Drought Monitor (USDM)**

2) **Evaluate the use of these products as indicators of environmental conditions that are pre-cursors of drought, increased fire danger, and vegetation health**

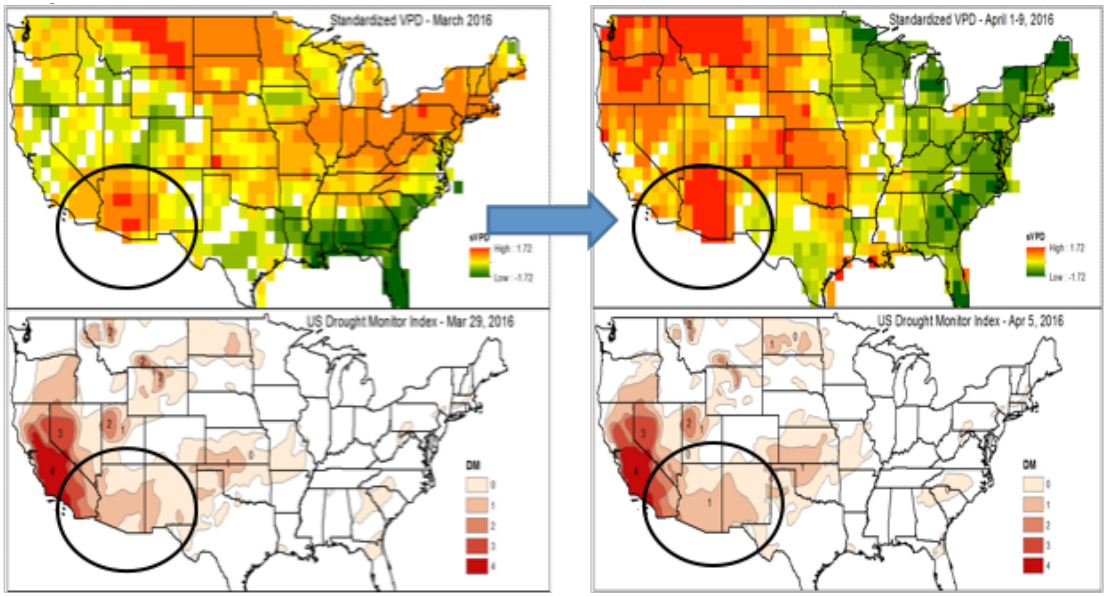
National Drought Mitigation Center



AIRS & Drought | Vapor Pressure Deficit & RH

- **AIRS derived standardized vapor pressure deficit (VPD) can be used for the monitoring and early detection of meteorological drought**

- **Near real-time monitoring of temperature and humidity can contribute to the early detection of drought, its development & dynamics**



Large anomaly in AIRS VPD in March 2016 over Arizona while USDM shows weak signals. In April, USDM begins to show wide-spread drought. Note USDM has difficulties in capturing rapid dynamics of drought due to inclusion of many variables that may change slowly.

Credit: Ali Behrangi

AIRS & Fire

The JPL Fire Danger Assessment System (FDAS): Using satellite observations to map global wildfire risk

JT Reager , Ali Behrangi , Natasha Stavros (JPL) & James Randerson (UCI)

OBJECTIVE

Build a formal relationship between JPL and the operational fire science community by assembling a global fire-potential mapped data product and making it publicly accessible

Rocky fire burns near Clearlake, Calif. on Aug. 1, 2015. Photo: TIME

There are no operational fire assessments that utilize NASA satellite information in a fire-risk predictive framework

Guidance and input of operational fire experts will contribute to development of new product

AIRS and the Indonesian Fires of 2015

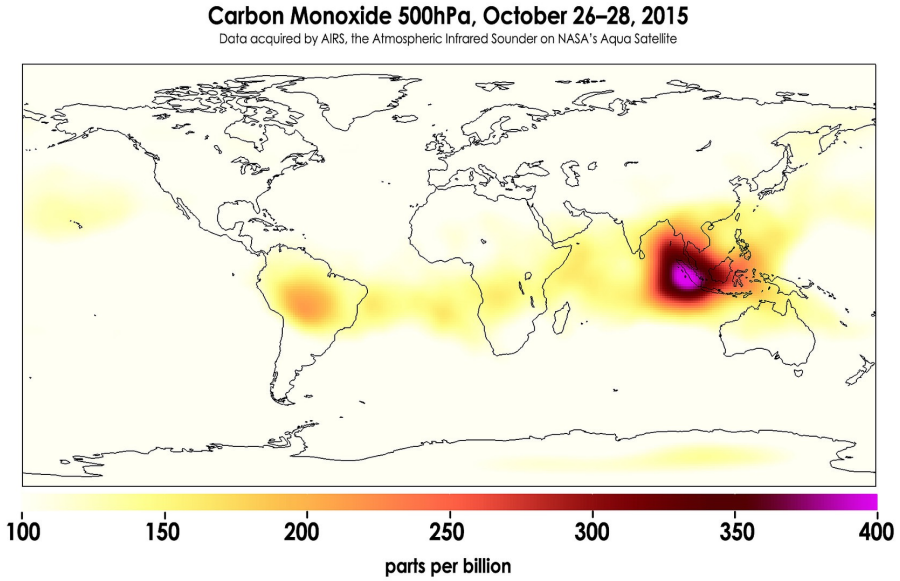
Indonesian military personnel fighting a large peat fire near the city of Palangkaraya in the Indonesian province of Central Kalimantan on Borneo. (October 14, 2015, David Gaveau, Center for International Forestry Research)

Indonesian fire activity and smoke pollution in 2015 show persistent nonlinear sensitivity to El Niño-induced drought

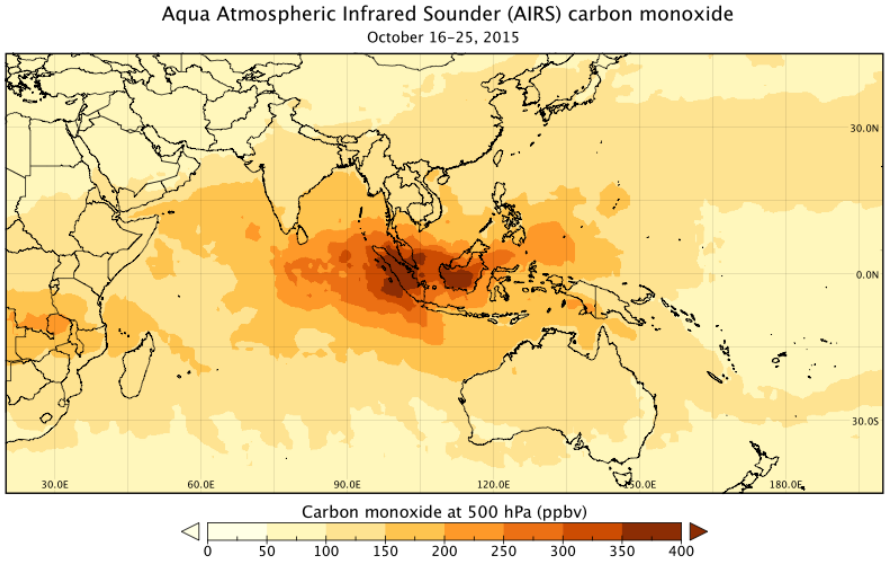
Field, Robert D., Guido R. van der Werf, Thierry Fanin, Eric J. Fetzer, Ryan Fuller, Hiren Jethva, Robert Levy et al. Proceedings of the National Academy of Sciences 113, no. 33 (2016): 9204-9209.

AIRS and Indonesian Fires of 2015

- Robert Field (& NASA GISS, Columbia University) specializes in climate modeling, fire science
- Dry season controlled fires remove waste, clear forestlands
- In years with El Niño-associated droughts, smoke from fires on degraded peat lands expose millions to polluted air
- 2015 worst fire year since 1997, six Indonesian provinces declare state of emergency
- Indonesia 2015 CO equivalent biomass burning emissions fell between 2013 fossil fuel CO emissions of Japan and India
- Data show Indonesian fire environment responds in nonlinear fashion to dry conditions during El Niño years & fire susceptibility increased over Indonesian Borneo
- Authors suggest meaningful land use reform and fire intervention tied to precipitation forecasts will help counter smoke pollution



Credit: NASA/JPL AIRS Project



Credit: Robert Field

Spring 2016 Science Team Meeting

Full Day Applications Session to:

- **introduce NASA Applied Sciences program**
- **show how applications differ from traditional science**
- **provide examples of how science is used in applications**
- **introduce services, tools to be used for applications**

Agenda, talks, meeting summary at

http://airs.jpl.nasa.gov/events/36